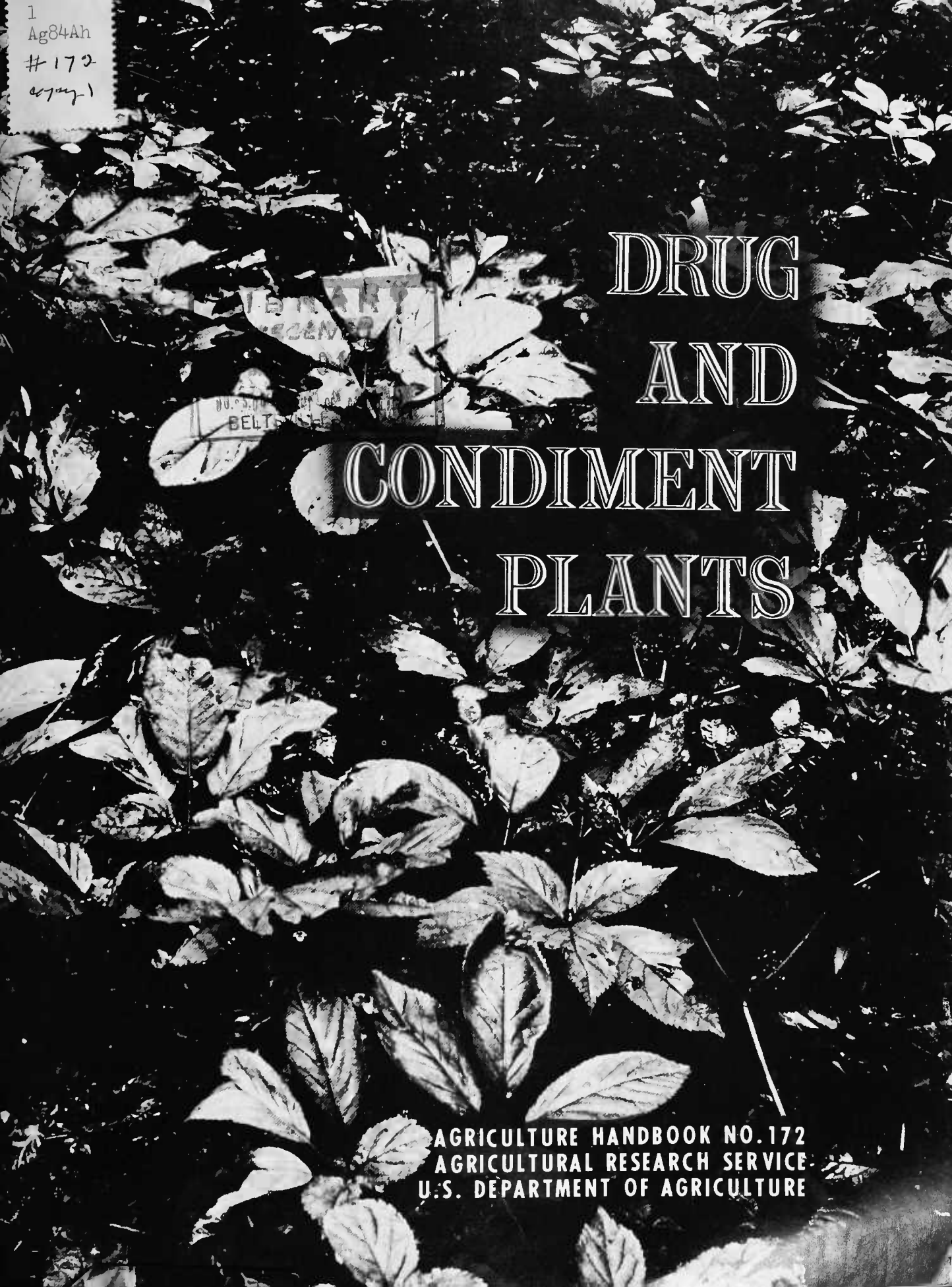

DRUG AND CONDIMENT PLANTS

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CONTENTS

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The U.S. Department of Agriculture does not recommend that the drug plants discussed in this handbook be used in home remedies. Most are not harmful, but some have constituents that may cause serious effects or even death if they are improperly used.

This Agriculture Handbook contains information of the type formerly presented in Farmers' Bulletins 1977, Savory Herbs: Culture and Use, and 1999, Production of Drug and Condiment Plants.

DRUG AND CONDIMENT PLANTS

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INTRODUCTION

Drug and condiment plants that may be grown in the United States are crops that can supplement the standard crops on a farm or can provide a small cash income. These crops should be grown on a trial basis to find out if they will provide a reasonable and additional income. Some of these crops, especially the condiments, may be grown for use on the farm. Some crops that have been specialty crops have now become regular crops. Castorbeans, sesame, guar, and safflower are examples of crops that have made the transition recently or are in the process of making that transition.

Several hundred, perhaps thousands, of plants are used as drugs or condiments by man. Relatively few are cultivated for the world market. Fewer still have great importance economically. Many drugs and condiments are gathered from wild plants or plants that have become naturalized.

The kinds of plants that are available on the drug or botanical drug market and the number of them used in "home remedies" but not usually available on the drug market are not known. One large firm offers about 600 botanical drugs for which botanical names are supplied. This must be few in comparison to the kinds actually used around the world.

Plants used as condiments are few compared to the number used as drugs. Perhaps not more than 100 are in common use; of these, possibly 25 may be of potential interest or importance to American specialty crop producers.

Some specialty crops come to the market from regions of the world where cost of production is low. Because the planting, cultivation, or harvesting of some of these crops require a relatively large investment in human labor, growing them in the United States often is not economically feasible.

There is a market for most of the plants discussed in this handbook. However, only a few would cause real concern to our national economy if the drug or condiment were not available. The cultivation of the esssential ones can be increased in case of national need. The acreage required to supply the demand for most drugs and condiments is relatively small. If production of certain drug and condiment plants becomes feasible, the acreage can usually be expanded quickly. For example, during World War II cultivation of belladonna and digitalis was expanded when imports to the United States were restricted.

DRUGS FROM PLANTS

The use of certain plants to relieve distress or illness is older than civilization. Primitive as well as civilized men, living in all parts of the world, have or have had a materia medica based on the plants available to them. Many plants today are used as specific remedies when they apparently have no real value. Many "herbs" used as remedies, in fact, have little or no medicinal value. A few drugs used in folk medicine have been of great value. Quinine is one.

An "official drug," as used in this handbook, is one recognized in the Pharmacopeia of the United States (*28*)[1] or the National Formulary of the American Pharmaceutical Association (*2*). The medical profession usually recognizes the drugs listed as possessing therapeutic value and good pharmacies may have these drugs in stock. The National Formulary describes the crude drugs and establishes official standards for them. Methods of determining the drug usually are given in detail. The Pharmacopeia is a therapeutic guide for doctors and pharmacists of a select list of medicines and for the most efficient ways in which the drugs may be used.

The Dispensatory of the United States of America (*19*) is an encyclopedic volume that presents information concerning "official" and many "nonofficial" drugs, as well as those used in veterinary medicine. The Dispensatory is an excellent source of information on drug plants.

[1] Italic numbers in parentheses refer to References, p. 33.

CONDIMENTS FROM PLANTS

Condiments usually are not considered foods, except in a few instances, such as the capsicum peppers; for condiments add little to the nutritive value of the foods with which they are used. Condiments do, however, add to the flavor and increase the attractiveness of a great many kinds of foods. In countries where refrigeration is not available, condiments may sometimes be used to mask undesirable flavors or odors in foods.

PRODUCTION OF DRUGS AND CONDIMENTS

Specialty crops may require, in addition to their cultural requirements, special processing, special machinery for harvesting or equipment for drying, distilling apparatus, or the equipment for some other process in their preparation as a drug or a condiment. Certain of these crops are grown year after year by a small group of farmers in a certain region, because the climate and soil there are favorable for the crop and the farmers have the equipment to handle it. These same conditions and requirements also may limit production by other growers.

Certain condiment plants, generally called herbs, are often grown in a kitchen garden or in an herb garden, either for profit or pleasure.

Drug and condiment plants are subject to the law of supply and demand, just as most other farm products. Few drug or condiment crops are in great enough demand to make their cultivation general. A relatively small increase in the supply of any one of them may cause a corresponding decrease in the market value.

Growing specialty crops offers little encouragement to inexperienced growers who are looking for large, quick returns from a small investment of time and money. Drug and condiment crops must be well grown and well prepared to be attractive to dealers and manufacturers. Some crops require 2 or more years of care before a crop may be harvested.

Diseases and pests that affect drug and condiment crops are as diverse as those that affect other crops. Viruses, wilts, leaf spots, root diseases, and others, as well as insect pests, are common among the drug and condiment plants. Diseases and pests must be recognized and methods of control worked out, if these crops are to be acceptable for the market.

MARKETS

Before growers consider the production of drug or condiment plants, they should find a satisfactory market. There are usually local buyers for a special crop that is produced regularly in a certain area. However, if there are no local buyers, lists are available of dealers that handle almost any speciality crop and who have lists of those drugs or condiments they buy.[2] The growers should request instructions from the dealers before they ship their product. Contracts are sometimes made by manufacturers or dealers with farmers to grow or supply certain speciality crops.

DESCRIPTIONS

It is impossible to describe in this handbook all the drug and condiment plants that are or that might be grown in the United States. The cultivation of many drug plants is not given, because the market requirements are satisfied by the harvesting of wild plants. Potential drug or condiment crops in process of development but for which there is no sure market now are not included. Some condiment plants generally grown as vegetable crops—garlic and onions, for instance—are not included, whereas capsicum peppers and parsley, often grown as vegetables, are discussed. Two plants producing narcotics—the opium poppy and hemp—have been excluded, as their cultivation is prohibited in the United States.

The descriptions that follow give first an appropriate common name for the plant. Synonymous common names by which the plant may be known are listed. The accepted botanical name follows. Other botanical names commonly in literature, if any, are given, as is the name of the family to which the plant belongs. A brief description of the plant follows and if the plant is an "official" drug, the official description, or a part of it, is quoted. History and constituents of the plant may be given. Propagation, cultivation, harvesting, and preparation of the crop for market are given when pertinent.

Aconite

(Monkshood, aconite root, wolfbane, friars cap, bluerocket)

Aconitum napellus L. Ranunculaceae

Aconite (fig. 1) is a perennial plant 2 to 4 feet tall, usually erect and strict; the leaves are 2 to 5

[2] A list of dealers in botanical drugs will be supplied, if requested, from the New Crops Research Branch, USDA, Plant Industry Station, Beltsville, Md. Also, sources of supply for most botanical drugs and condiments can be given by the above Branch.

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Figure 1.—Aconite.

inches broad, divided to near the base and again divided into lanceolate or linear segments; the flowers are bluish or purple, borne in spikelike terminal racemes; the roots, which are the source of the official drug, are cone-shaped and tuberlike and may be up to 4 inches long and 1½ inches thick; they are brownish in color. The plant is variable in all respects. There are a number of described subspecies, varieties, forms, and clones.

The drug is official (*2*), "Aconite is the dried tuberous root of *Aconitum Napellus* Linné."

Aconite is a relatively unimportant drug in the United States, as it is used now much less than formerly. Aconite liniment is used externally for rheumatism and neuralgia or as a counterirritant. The principal alkaloid, aconitine, stimulates and then depresses the central and peripheral nervous system. It has been used as a cardiac depressant in high blood pressure of cardiac origin. The root is poisonous, and aconite or aconite root should not be used except on advice of a physician.

Aconitum napellus occurs in the mountains of Europe and Asia. There are several varieties, at least one of which extends into North America, from Alaska southward to British Columbia.

Mountain regions in the Temperate Zone where the climate is cool and where shade and well-drained sandy loam are available are a satisfactory place to grow aconite. It is unlikely that cultivation of the plant would be profitable in America. No plantations are known here. Propagation is preferably done with root divisions. Plants may not come true from seed, owing to possibility of hybridization with undesirable species. Several species of *Aconitum* contain the alkaloid aconitine, but *Aconitum napellus* is the only one that may be used in official preparations. Yields are estimated as 400 to 500 pounds of dried root per acre. It requires 2 years or more to mature a crop if grown from seed.

The roots are collected in the fall, preferably after the stems have died down. Tubers are cleaned and the small fibrous roots removed, then carefully dried. It should not be broken up to facilitate drying.

No figures are available on the amount of aconite root imported, but the annual average is not much more than 1 ton.

Agar

(Agar-agar, vegetable gelatine, gelosa, Chinese or Japanese gelatin, Japanese isinglass)

Gelidium cartilagineum (L.) Gaillon (Gelidaceae); *Gracilaria confervoides* (L.) Grev. (Sphaerococcaceae), and related red algae (Rhodophyceae).

The plants from which agar is produced are the red algae given above, as well as a number of other species that are important in the United States. Agar U.S.P. may be made from these species and is also from *Gelidium amansii* Lamouroux, *Ahnfeltia plicata* (Huds.) Fries, *Endocladia muricata* (P. & B.) J. G. Ag., *Hypnea muciformis* (Wulfen) Lamouroux, and perhaps a number of others. There are other red algae that produce agarlike substances called agaroids. These do not meet U.S.P. specifications for agar. A colloidal polysaccharide, algin, is obtained from brown algae.

Agar is a dried hydrophilous colloidal substance extracted from the red algae mentioned.

Agar is used medicinally as a laxative and quite commonly used in chronic constipation. It is often combined with cascara sagrada or other vegetable cathartics. Agar is used for a number of other purposes. It is important as a culture medium in bacteriological and mycological work; it is used to provide bulk and consistency in candies, jellies, ice cream, and other foods. It has several industrial uses: In clarifying liquids, in sizing, and in cosmetics.

Most agar used in the United States prior to World War II was imported from Japan. Since that time American sources have been developed and a large part of the agar is produced here. In 1958 about 234 tons of agar were imported; Japan, Morocco, and Spain were the largest suppliers.

The use of seaweeds as food probably goes back beyond historic time. The Japanese and other Oriental people have used extractives of seaweeds as food and medicine and in industry for more

than 300 years. That agar could be dehydrated and purified by a process of freezing and thawing was discovered in Japan by accident. An agar industry developed in Japan as a result of the discovery, and the use of agar increased rapidly.

The useful constituent of agar is gelose, a complex polysaccharide that has outstanding gel-forming capacity.

Red algae occur around the shores of most of the world. Many species have been used in the preparation of agar and agaroids. The algae have been "farmed" by the Japanese.

Agar is prepared by various methods. In America the usual process is to wash thoroughly the dried seaweed and then to cook it for 2 to 6 hours. The seaweed residue is then strained out and the remaining solution run into a high-temperature tank and filtered and bleached. Bleaching may be done before filtering. The agar solution is cooled and gelled, then frozen, and then crushed and melted. The agar is then separated from the water and dried. It is usually marketed as flakes or granules.

See references *15* and *16*.

Aloes

(Curaçao aloe, West Indian aloe)

Aloe barbadensis Miller. Liliaceae

(*A. vulgaris* Lam., *A. vera* of authors.)

There are many kinds of aloes.[3] The Netherlands Antilles are large producers. The aloes come from the species mentioned above or a similar one sometimes determined as "*Aloe vera.*" The rest of the aloes imported come principally from Union of South Africa, but they may come from other regions as well. Several species of *Aloe* are involved in the African aloes. Perhaps the most hardy *Aloe* is *Aloe barbadensis*, which may be grown in Florida and the warmer gulf coast.

Aloes (*28, p. 29*) is the dried juice from the leaves of *Aloe barbadensis* and of several other species of *Aloe*. It should yield not less than 50 percent of a water-soluble extractive. The composition of aloes from different species varies.

Curaçao aloes began to appear in the early part of the last century and is now the principal aloes on the market.

Aloes is used medicinally as a cathartic. "Aloin" is the name applied to the mixture of active principles, mostly bitter pentosides. Curaçao aloes contains isobarbaloin in addition.

Aloe grows wild in many parts of Africa, especially in semiarid regions. Aloes is made from wild plants or from cultivated ones. In the Netherlands Antilles all the aloes and aloin are derived from cultivated plants. The aloin is precipitated from the fresh juice there, and then purified to U.S.P. by crystallization. This method is more efficient than the old empirical method of concentration of the juice by evaporation to aloes, in which form it was usually shipped.

Propagation of aloes is usually by offsets. The plants are set 6 to 12 inches apart in rows that are 18 to 24 inches apart, with adequate drainage ditch between. Plants may be productive for 10 years or more but produce well only for 5 to 6 years. The lower leaves of the plant are cut off when mature and the juice is drained out. The aloin is precipitated out of the juice or the juice is concentrated and solidified by evaporation.

The production of aloes in this country will probably not be profitable.

See reference *13*.

Althea

(Marshmallow, marshmallow root, white mallow)

Althaea officinalis L. Malvaceae

Althea (fig. 2) consists of the dried roots of the plants from which the small roots and brown

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Figure 2.—Althea.

[3] The crude drug is known either as aloes or aloe. The form with "s" may be preferable. It is syntactically singular.

corky covering have been removed. It is official in the National Formulary.

Althea is used as a demulcent. It is a relatively unimportant drug plant. The dried root contains up to 35 percent of mucilage.

The plant is native to Europe, but it has been naturalized along the New England coast and in tidal rivers south to Pennsylvania. All the drug in the American market comes from Europe. The roots are collected in the fall, washed, peeled, and dried. It has not been cultivated in this country. The small demand and low price perhaps would not make cultivation profitable.

Angelica

(Angelica root, angelica seed)

Angelica archangelica L. and *A. atropurpurea* L. Umbelliferae

Both seeds and roots of angelica (fig. 3) are used. The root is dug, preferably from plants 1 year old or in the fall of the second year. The roots are large and fleshy with many rootlets; the stem is usually hollow and purplish and grows to 4 to 6 feet or even more. The flowers are greenish white and in the usual umbel. The seeds are oval, usually yellow or yellowish brown, and are pungent and sweet. Both the roots and seeds, and the essential oil distilled from them, are used as flavoring, stimulant, and carminative. The leaves and stems are used as a condiment. The medicinal value of angelica is relatively little. The belief that it had medicinal properties was perhaps based on the thought that aromatic herbs were medicinal. The American *Angelica atropurpurea* is said to be much inferior to the European *A. archangelica*.

Angelica is cultivated in Europe, mainly in Belgium, France, and Germany. It grows best on rich soil in a temperate to cool climate. It is grown in kitchen and herb gardens in the United States, but probably is nowhere commercially cultivated. Most root and seed is perhaps distilled for its essential oil. The oil is more easily controlled as a flavoring material than are roots or seeds.

World production of both seed and root perhaps does not exceed 100 tons. It is doubtful if the crop could be economically produced in the United States.

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Figure 3.—Angelica.

Anise

(Anise seed, anise oil)

Pimpinella anisum L. Umbelliferae

Anise (fig. 4) is an annual herb widely cultivated and often spontaneous, in much of the temperate and tropical regions of the world. It is about a foot or two tall, the leaves are opposite below, alternate above, pinnatifid or ternate, with cut, cuneate, or entire segments. The fruit consists of two puberulent mericarps or "seeds." Anise oil is a volatile oil distilled with steam from dried, ripe fruits.

Anise is widely used as a flavoring agent, stimulant, and carminative; it finds use in flavoring bakery goods, confectioneries, liqueurs, and other

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Figure 4.—Anise.

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products. The oil has replaced the seed in flavoring many products. The principal constitutent of the oil is anithol.

Anise has been in cultivation in the Mediterranean basin for many centuries and is cultivated in a few areas in the United States. Spain supplies most of the seed imported to the United States, and is followed by Mexico, Turkey, and India.

Anise requires a rather long season, about 120 to 130 days from date of sowing. It may be sown in rows 18 to 30 inches apart, and about one half inch deep; the plants are thinned 6 to 8 inches apart in rows. Uniform rainfall or irrigation is required. Temperatures that do not go too high and are quite even are best.

The plants may be harvested by pulling the plants or by cutting off the fruiting inflorescences. It is usually done while the seeds are still green. The plants are tied in bundles and stacked with the heads in. The seed should ripen and dry in about a week and is then ready for threshing. In Europe threshing is usually done by hand.

Arnica

(Wolfs-bane, arnica flowers, American arnica, European arnica)

Arnica montana L., European arnica, and three American species—*A. fulgens* Pursh, *A. sororia* Greene, and *A. cordifolia* Hook—are all official. Compositae

Arnica (*2*, *p. 62*) officially consists of the dried flower heads of the species mentioned above. The powdered drug is yellowish brown. The flowers contain arnicin, a small amount of volatile oil, resin, tannin, etc.

Arnica, or arnica tincture, is a very old remedy, used as a counterirritant in sprains and bruises, but now rarely prescribed by physicians. The use of arnica in recent years has dwindled, owing to the use of more potent or efficacious synthetic painkillers.

Arnica montana grows wild in Europe, the Alps being the principal source of the flowers. *A. fulgens*, *A. sororia*, and *A. cordifolia* occur in meadows and woods along the slopes of the Rocky Mountains from British Columbia and Alberta south to New Mexico. The American arnicas are often considered superior to that of Europe because of cleanliness and lack of infestation by insects. Arnica has rarely been cultivated in the United States, and is harvested usually from wild plants. The flower heads when dried are ready for market.

See reference *12*.

Basil

(Sweet basil, garden basil)

Ocimum basilicum L. Labiatae

Basil (fig. 5) is a glabrous or slightly pubescent annual herb that grows 1 to 2 feet tall; the leaves

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Figure 5.—Basil.

are petiolate, ovate, 1 to 2 inches long, entire or dentate; flowers are white or slightly purplish, in racemes.

Basil is grown in kitchen or herb gardens as a condiment to flavor meat, poultry, soups, stews, and other foods. The essential oil, which is distilled from the herb, is used also in flavoring and in perfumes. Basil has been used since ancient times as a condiment and as a medicinal herb. It is not now used in medicine.

Many varieties of basil are cultivated, but they are difficult to distinguish one from another. One variety, grown in France under the name *grand basilic*, and a crisped-leaf variety are said to be the two best for distillation of oil. Most basil oil is distilled in the south of France. Basil can be grown in most parts of the United States where conditions for vegetable crops are favorable.

There are several varieties of oil of basil. That known as oil of sweet basil, distilled from the plants mentioned above, is most desirable. The principal constituent of this oil is *l*-linaloöl.

The plant is a native of Africa and perhaps also India, but basil is now widely distributed in temperate and some tropical parts of the world.

Soil for basil should be plowed in the fall and smoothed in spring before planting. The seeds are drilled about 12 to the foot and covered not more than one-half inch. Rows are 2 to 3 feet apart. Seed should be sown as soon as danger of first

frost is passed. The first cutting is made about 2½ to 3 months after planting and a second crop may be had in another 8 weeks.

The oil is prepared by distillation of the herb. The requirement of the American market for oil of basil is relatively little.

Belladonna

(Belladonna leaf, belladonna root, deadly nightshade)

Atropa belladonna L. and *A. belladonna* var. *acuminata* Royle — Solanaceae

Belladonna (fig. 6) is a leafy, much-branched perennial herb 2 to 3 feet tall; leaves are entire, ovate or oblong-ovate; corolla is bell- or funnel-shaped; fruit is a shining black and poisonous berry.

The drug is obtained from either leaves or roots; both are official (*28, p. 79; 2, p. 80*). The dried leaves and flowering or fruiting tops should yield not less than 0.35 percent of alkaloid (U.S.P.). The roots should yield not less than 0.45 percent of alkaloid.

The principal alkaloids contained in both leaves and roots are hyoscyamine, atropine, belladonnine, and scopolamine.

The uses of belladonna are many; it is one of the most useful of plant drugs. Principal uses are as a sedative, antiasthmatic, mydriatic, and to check secretion.

Belladonna is native to Europe and Asia and has been known and used for about 500 years. The leaves became an official drug in United States in 1820; the roots in 1860. Most belladonna was imported into the United States until the two World Wars, when supplies from the Old World were restricted.

Cultivation of belladonna is not difficult, and it has been successfully grown in many regions of the United States, especially in Pennsylvania, New Jersey, Minnesota, Michigan, Indiana, California, and Washington. Well-drained loamy soils suitable for vegetable culture are suitable for belladonna. Propagation is from seeds, which may be started late in the winter in a greenhouse or a cold-frame, or in a seedbed outdoors in early spring. Seed is often slow in germinating. An ounce of seed will provide plants for an acre of land. Plants are set out, as soon as danger of frost is over, 20 inches apart in rows 30 or more inches apart. Field sowing of seed is usually not satisfactory. The crop requires some hand weeding. Insect pests must be controlled by spraying. If large plants are set out, more than one crop can be obtained in the season.

The leaves and flowering tops may be harvested as soon as the plant blooms. They should be carefully dried in the shade to retain their green color. Artificial heat may be required to dry large lots of the herb. The roots may be harvested in the fall, cleaned, cut into sections, and dried in the sun or in a drier. A yield of 600 pounds of dried herb and about 150 to 300 pounds of root per acre may be expected in favorable localities.

See reference *31*.

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Figure 6.—Belladonna.

Blessed Thistle

(Holy thistle, bitter thistle, Our Ladys thistle, cursed thistle, bitterweed)

Cnicus benedictus L. — Compositae

Blessed thistle (fig. 7) is a branching annual plant up to 2 feet tall, stems pubescent. Flower

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Figure 7.—Blessed thistle.

heads are sessile, without rays, yellow. Leaves are oblong, 2 to 6 inches long, sinuate to nearly pinnatifid, spinescent, exceedingly bitter to the taste.

Blessed thistle is used in home remedies and perhaps in patent medicines as a bitter tonic. Quite probably it enters into the manufacture of the "bitters" used in certain alcoholic concoctions and might find use wherever bitters are required.

Blessed thistle is a native of Europe; adventive as a weed in the United States and elsewhere. Occasionally it is planted as a crop. This plant may be a serious weed in grainfields, and this fact should be considered before planting.

Blessed thistle may be sown one-half inch deep in rows about 3 feet apart, or to suit available cultivating machinery. The seedlings should be thinned to about 18 inches apart in the rows. The plants may be harvested as soon as they begin to bloom. The herb is cut just above ground level and it should be dried in the shade in well-ventilated sheds or tobacco barns. It is usually baled for market.

Burdock

(Lappa, burdock root, beggars buttons)

Arctium lappa L. and *A. minus* (Hill) Bernh. Compositae

The two species of burdock given above are sometimes used in domestic medicine. The root is the part generally used, although the "seeds," often the fruits, are used. First-year roots are preferred. Burdocks are usually coarse biennial herbs (fig. 8). The first year's growth is a rosette of rough, cordate-ovate leaves.

Burdock is used as an alterative, diaphoretic, and diuretic, and as a "blood purifier." John Parkinson in 1640 wrote, "The juice of leaves given to drink with old wine doth wonderfully help the biting of any serpents, as also of a mad dogge." Burdock leaves and roots were at one time official. Neither are now.

Burdock is native of Europe and has become naturalized as a weed along ditchbanks and in fields in the eastern half of the United States. The roots are collected from wild or cultivated plants in their first autumn. Some are imported from Europe.

In Japan, and where there are Japanese people, the roots of burdock are an important food. The roots may be boiled in salted water and eaten with butter or sauce, like salsify.

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Figure 8.—Burdock.

Calendula

(Marigold, garden marigold)

Calendula officinalis L. Compositae

Calendulas (fig. 9) are annuals that are commonly cultivated in flower gardens and grow 1 to 2 feet tall. Leaves are oblong, dentate; flowers about 2 inches in diameter, with many yellow to orange ray flowers ("petals"). Tincture of the

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Figure 9.—Calendula.

petals is used in healing of wounds. The petals have also been used as a butter dye. It is little used for either purpose now.

The ligulate, or ray, flowers are taken from the heads and dried. Orange or deep yellow ones are preferred. Most of the drug is imported from Europe; a small amount is produced in the United States. The hand labor required in harvesting probably would make the crop unattractive here.

Camomile (Hungarian, German)

(Sweet false-camomile, chamomile, wild camomile)

Matricaria chamomilla L. Compositae

Hungarian, or German, camomile (fig. 10) is a much branched annual that grows to 2 feet tall; leaves are 2 to 3 times pinnately divided into short linear segments; and flowers nearly an inch across, with about 10 to 20 white ray flowers. It has the fragrance of pineapple.

Medical use of camomile in the United States is little. It has been used as an aromatic bitter and a mild tonic; it is emetic in large doses. It contains an essential oil and a bitter principle (anthemic acid).

Camomile is a European plant and has been naturalized in America. Most all camomile used in the United States is imported from Europe, although some is produced in Argentina and Colombia.

Seeds may be drilled or sown broadcast and barely covered. A moderately rich moist soil is preferred. About 8 weeks is required from seed for harvest, so sometimes 2 crops a year may be obtained. The heads are harvested when the plants are in full bloom. Harvesting is usually done by hand in Europe but some kind of stripper would be useful. The amount of hand labor required probably would make the crop unprofitable in the United States.

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Figure 10.—Camomile (Hungarian, German).

Camomile (Roman, English)

(Camomile flowers, garden-camomile)

Anthemis nobilis L. Compositae

The Roman, or English, camomile (fig. 11) is a perennial herb with creeping basal shoots, much branched, 6 to 12 inches tall, downy pubescent, aromatic; the flower is an inch or less across, ray flowers white; leaves bipinnate, the segments linear to filiform.

Medical use is almost nonexistent, except as a home remedy. It is an aromatic bitter, emetic if taken in large quantities. Flowers contain an essential oil.

The plant has often been cultivated in England, Belgium, France, and Germany. High labor costs may make it unprofitable, as a crop, in the United States.

Propagation is from seed or cuttings. The seed is sown in the field about 10 inches apart, in rows that permit access. Flowers are handpicked when mature, in dry weather. They must be quickly dried to maintain natural color.

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Figure 11.—Camomile (Roman, English).

Capsicum Peppers

Capsicum annuum L. and its varieties *frutescens* (L.) Kuntze; var. *fasciculatum* (Sturt.) Irish; var. *grossum* Sendt.; and var. *longum* Sendt. Solanaceae

The varieties of peppers cultivated for condiment and medicine correspond approximately to the following:

Variety *frutescens*.—The bird peppers, wild, spontaneous or cultivated in the tropics and subtropics; much used in Latin America.

Variety *fasciculatum*.—The very pungent red cluster peppers.

Variety *grossum*.—Sweet or bell peppers; to this variety belong most of the commercial sweet peppers and the mild paprika peppers commonly grown in Europe and America.

Variety *longum*.—The long peppers, which include most of the chile peppers, cayenne peppers, the long reds, and the long yellows; to this variety belong many of the pungent peppers used by Latin American peoples as condiments in cooked foods. Literally hundreds of local names exist in Latin America for variations, local or otherwise, of these peppers. A recipe may call for two to six kinds by their local names.

The peppers, which might be called capsicums or capsicum peppers (fig. 12) to distinguish them from the unrelated true peppers, are America's most important contribution to the world's condiments. The classification of the cultivated economic peppers still requires much study, but the one given above is perhaps as good as any, based on present knowledge of them.

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Figure 12.—Capsicum pepper.

Peppers are native to America. Cultivated kinds were widely distributed in America before the time of its discovery.

Certain of the pungent peppers are official drugs (*28, p. 132*) used in medicine, where they are called *Capsicum*. They are used as stimulants, counterirritants, and stomachics.

Farmers' Bulletin 2051, "Pepper Production, Disease and Insect Control," describes the more common varieties of peppers, methods of culture, and control of diseases and insects. It may be requested from Office of Information, U.S. Department of Agriculture, Washington 25, D.C.

See reference *22*.

Caraway

(Caraway seed, caraway fruit)

Carum carvi L. Umbelliferae

Caraway (fig. 13) is an annual or biennial plant, with leaves pinnately decompounded into narrow linear segments; the fruits (seeds), about one-eighth inch long, are strongly ribbed, laterally compressed. The portion used is the seed.

Caraway is used as a condiment. The seeds, or the oil distilled from them, may be used. In medicine, both seeds and oil are used as a carminative or flavoring.

The principal constitutent of caraway oil is carvone, about 50 to 60 percent. Seed is sold,

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Figure 13.—Caraway.

with the price based on oil content. This may vary in Dutch seed from 3 to 6 percent (average, 4 percent). Caraway has probably been in cultivation for 1,000 years and has been in medicine for perhaps 600 or more.

Caraway is of Old World origin and is now distributed and naturalized around the world in temperate zones. It is cultivated in north and central Europe, England, Morocco, and at one time it was grown in the United States.

The plant is grown either as an annual or as a biennial. The seed may be sown directly in the field, about 15 inches apart in rows. Space must be left for weeding. As soon as the first seeds are ripe, the plants are cut and partially dried in windrows, weather permitting. They are then moved into a shed or barn or placed over large canvases for complete drying. Shattering is likely to be excessive unless care is taken in handling. Complete separation of the seed may be done with a flail or threshing machine. Where weather permits, the caraway may be left until the seeds are mature, then harvested with a combine with a special attachment that elevates the material into the combine without too much seed loss. Limited experience in the United States indicates caraway will produce 700 to 1,200 pounds of seed per acre for the biennial crop and about 700 pounds for the annual crop. The crop may not be profitable in the United States on commercial scale.

Cascara Sagrada

(Chittem bark, sacred bark, bearwood, cascara buckthorn, coffeeberry, bearberry, wahoo)

Rhamnus purshiana DC. Rhamnaceae

Cascara sagrada is the dried bark of *Rhamnus purshiana*. It should be aged for at least 1 year before it is used. The tree grows to 25 feet tall, the leaves (fig. 14) are elliptic to oblong-ovate, acute to obtuse, dentate to nearly entire, 2 to 6 inches long. The bark, which is the part of the plant used as an official drug (*18, p. 132*), is from $\frac{1}{10}$ to $\frac{1}{4}$ inch thick; when fresh the inner surface is bright yellow, but it darkens with exposure to light; it is bitter.

The principal use of cascara sagrada is as a tonic laxative or cathartic; it contains anthraquinone derivatives, resins, tannin, glucose, starch, and other compounds. It is one of the best vegetable laxatives and appears to restore tone to the relaxed bowel and thus to produce a lasting beneficial effect.

The drug is collected from wild trees in Washington, Oregon, and California. However, small plantations have been started in the Pacific Northwest and in Kenya, but mostly the plantings have been unsuccessful. The bark from the trees in Kenya was an inferior grade.

Bark harvest lasts from mid-April until the end of August. The bark is often collected from trees

PN-723

Figure 14.—Cascara sagrada.

in the mountains and packed out by men or animals to the drying area. Considerable labor is involved. The bark is removed from the trees with a spud, and is taken from both the bole and branches. A bark-covered stump about 6 to 8 inches high should be left; the stump is cut at an angle so that it sheds rain. Such stumps will produce suckers and in due time another crop of bark. It requires 4 to 5 days for the bark to dry. It must be protected from rain or loss of the drug occurs. The bark is broken into small pieces, after drying, and is ready for shipment.

Good peelers are said to be able to peel 100 to 250 pounds of bark a day under favorable conditions.

See reference *24*.

Castorbean

(Castor oilseed, castor oil plant, castor oil, Palma Christi)

Ricinus communis L. Euphorbiaceae

Ricinus is a tree growing to 40 feet tall, with stems occasionally a foot in diameter. In cultivation in temperate regions it is often grown as an annual. Some large-leaved forms are grown as ornamentals.

Castorbean (fig. 15) is now a commercial crop in the United States. Medicinally, castor oil is used as a purgative and lubricant. The oil used

PN-700

Figure 15.—Castorbean.

in medicine is obtained by cold expression and has a mild odor and, usually, a nauseating taste. The use of the oil in medicine, as an official drug (*28, p. 133*), is a minor usage.

See reference *29*.

Celery

(Celery seeds, celery fruit, oil of celery)

Apium graveolens L. and var. *dulce* (Mill.) DC.
Umbelliferae

Celery (fig. 16) is a biennial plant, occasionally grown as an annual. The stems are erect, branched, 2 to 3 feet tall; or in kinds grown for seed, to 7 feet tall. Leaves are odd-pinnate, ovate to oblong, petiole long and fleshy and usually solid, leaflets 5 to 7, ternately compounded and petiolulate; the compound umbels are among the leaves.

Celery is used as a green vegetable or condiment, either raw or cooked. The vegetable is the leafstalks of the plant, which are usually blanched. Oil of celery, which is distilled from the seeds, is used as a condiment in flavoring food products—soups, meats, sauces, and celery salt—to which it imparts a pleasing aromatic odor and flavor. The oil has been used in medicine as a stimulant and carminative, as well as flavoring. An oleoresin is also made from the seeds. This is used as a food flavoring and in some applications is easier to use than the oil.

Celery is native to Europe, North Africa, and parts of Asia. The wild plant is bitter and said to be poisonous. The modifications in cultivation are many and the cultivated species actually have been given a distinctive scientific name. Celery as a vegetable is grown over the temperate and subtropical regions of the world and occasionally

PN-701

Figure 16.—Celery.

in the tropics. The plant grown for seed may be cultivated in temperate or semitropical regions. India is now the principal source of seed for distillation of the essential oil. Celery as a vegetable can be grown successfully in many parts of the United States.

Celery may be grown for a seed crop in several ways, depending on climatic conditions. In the Sacramento and Santa Clara Valleys, Calif., where most of the seed required for planting is produced, the usual practice is to start the seedlings in summer and transplant them to the field in fall in checkrows about 3 feet apart. The freezing temperatures that sometimes occur in this region apparently do not damage the plants. In spring the plants grow rapidly and by midsummer they produce many flower heads, which mature in August. In the Eastern States, the plants are often grown as annuals by chilling the seedlings in the seedbed early in spring, which causes the plants to produce seedstalks that season. Another practice is to carry the plants through the winter by protecting them with a heavy mulch against severe freezing. These cultural methods are used in growing celery seed for the vegetable-seed trade, for which higher prices are obtained than could be expected under normal conditions for seed to be used as condiments.

Current use of imported celery seed for distillation amounts to approximately 1,000 tons a year.

Chondrus

(Irish moss, carrageen, salt rock moss)

Chondrus crispus (L.) Stackh. or *Gigartina mamillosa* (Gooden. & Woodw.) J. Ag. Gigartinaceae

Irish moss occurs along the coast of New England, and from Norway to Gibraltar, growing submerged on rocks below the level of low tide. The plants involved are red algae.

Chondrus is used as a demulcent and nutrient; as an emulsifying agent; and as a vehicle for certain cosmetics. The main constituent is a mucilaginous principle, carragenin.

The "moss" is collected in America, mainly along the coast of Massachusetts, much of it near Scituate, and northward to Nova Scotia. The collectors, in small boats, harvest the moss from the rocks with long-handled rakes or they pick it up from the beach after storms. It is spread on the beach or on floors to dry and bleach in the sun and dew. It is then soaked in sea water and again dried and bleached until the "moss" is a pale yellow. When completely dry and sufficiently bleached, it is stored in barrels or marketed.

See reference *25*.

Colchicum

(Meadow saffron, autumn crocus, colchicum-root, meadow saffron corm)

Colchicum autumnale L. Liliaceae

Both the corm and the seeds of colchicum (fig. 17) have been used in medicine. Rarely is the crude drug (*2, p. 174*) prescribed any more; rather the alkaloid colchicine (*28, p. 170*) is used, because it has proved to be more reliable and otherwise satisfactory.

The principal medicinal use of colchicine, derived from either the corm or the seeds of colchicum, is in the treatment of gouty arthritis. The use of colchicum, as a treatment for gout, has been known for centuries, but how it acts is still not known. *Colchicine and the bulbs and seeds of colchicum are extremely toxic. They must not be experimented with as home remedies.* Care should be taken in handling them.

Colchicine is an important tool in plant genetic studies. It arrests cellular mitosis in the metaphase and is utilized by biologists to produce changes in genetic behavior.

Colchicum is native to England, to central and southern Europe, and to northern Africa.

Colchicum has been cultivated in the United States, but as a crop it has not been economically feasible. The plant grows best in moist rich sandy loam, either in partial shade or sun. In cold areas it may require some protection in winter. Propagation may be by seed or corms. Seeds are

PN-702

Figure 17.—Colchicum.

planted as soon as mature, in June or July, but seedlings do not emerge until the following spring and will not flower until 3 to 5 years old. Corms may be used for propagation, new corms are formed from old ones much as in tulips. Seeds may be harvested (and dried) when ripe. Corms are usually harvested as soon as the leaves die. They may be dried with the aid of heat. Year-old corms contain most alkaloid. The leaves are reported to contain more alkaloid than either corms or seeds but have not been much used.

Most of the crude drug, both seeds and corm, is imported from Europe.

See reference *4*.

Colocynth

(Colocynth apples, bitter apples, colocynth pulp)

Citrullus colocynthis (L.) Schrad. Cucurbitaceae

Colocynth is a monocious, annual or perennial vine; the flowers are yellow and axillary; the fruit is a globose, three-celled berry with a hard shell-like epicarp. The drug is the dried pulp of the mature but unripe fruits. Most of the material that gets into the drug market comes from the Sudan. The plant is native to semi-desert regions of Africa and Asia. It has become naturalized or is cultivated in many parts of the world. In India it is abundant as an escape. It

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has been grown in New Mexico and possibly elsewhere in the United States.

Colocynth is used as a hydragogue cathartic. It is powerful, and when improperly used may cause death. The official drug (*2, p. 177*) "is the dried pulp of the unripe but full-grown fruit."

The action of the drug is caused by two active principles, an amorphous alkaloid and a resin, both of which are violent purgatives.

Cultivation in semidesert regions with 10 to 15 inches of rain annually is feasible. Grown as an annual, it could be planted in early spring and harvested in fall. Sandy loam soils are preferable, and little cultivation is needed after sowing. A single plant may have several stems, 20 to 30 feet long, that often root at nodes. The potential of the plant as a cultivated crop would not seem to be great.

Coriander

(Corlander seed, coriander fruit, coriander oil)

Coriandrum sativum L. Umbelliferae

Coriander is the dried ripe fruits of the plant (*2, p. 179*). The plants are annual, rather rank-smelling, branched herbs, up to 2 or 3 feet tall. The upper leaves are bi- or tripinnate, with segments linear or nearly so. Coriander seeds should yield not less than 0.25 cubic centimeter of volatile coriander oil from each 100 grams of the drug.

Coriander is used mainly as a flavoring agent in medicine as a carminative or to mask the flavor of other ingredients; it also is used to correct griping qualities of some cathartics, as senna and rhubarb. The essential oil is the part used as an official drug (*28, p. 174*).

Coriander has been cultivated, or used, since ancient times. The plant is native to Europe and Asia and is widely naturalized in temperate and subtropical parts of the world. It is or has been cultivated in most of the same regions. In the United States, Kentucky produces more than elsewhere. Most all seed and oil needed in the United States is now imported.

Coriander may be grown under many conditions, but does best in sunny locations on well-drained loams of limestone regions. About 75 to 80 days are required for maturity for early varieties in the east, whereas 215 to 220 days are needed for a California location for late varieties. The early varieties are best for condiment or spice purposes, but the late varieties are higher in oil content. Rains and winds during harvest periods may cause discoloration of seed.

Coriander is sown in rows 15 to 30 inches apart, the seeds planted about 1 inch deep, at the rate of 10 to 15 pounds to the acre. Cultivation to control weeds is recommended, and some hand weeding may be required. Planting may be made in May for maturity in August. In the Southwest seeds are usually sown in November, to mature in May.

Harvest is by hand on small plots or by mower or binder in field plantings. Seed does not mature all at one time and care must be taken to avoid shattering and to get as complete seed maturity as possible.

See reference *18*.

Cumin

(Cumin seed, cumin fruits)

Cuminum cyminum L. Umbelliferae

A slender annual that is much branched above; leaves dissected, the segments filiform; flowers white or pink. Cumin is native to the Mediterranean regions and much of the crop is cultivated there now. It is spontaneous in many parts of the world. Cumin is the seeds or fruit of the plant.

Cumin is a condiment or spice that is used to flavor foods of various kinds, bread, cheeses, sausages, and as a flavoring in such dishes as chile con carne and other similar dishes.

The plant grows best on well-drained rich sandy loams where a mild and equitable growing season is 3 to 4 months long. The plants are grown from seed and should be planted in rows to permit easy cultivation. In the areas of cultivation in the Old World where hand labor is not too costly, the crop is sown broadcast but the crop must then be hand weeded. The crop is ready to harvest when the plant withers and the seed loses its dark green color. Much of the crop in the Mediterranean region is hand harvested and threshed. A more economical method would be required were the crop grown in the United States. Yields are about 500 pounds of seed to the acre under reasonably good conditions.

Dandelion

(Taraxacum, blowballs, lions tooth)

Taraxacum officinale Weber and *T. erythrospermum* Andrz. Compositae

Dandelions (fig. 18) are perennial herbs; with leaves basal, pinnatifid, runcinate, lacerate to nearly entire. Flowers are ligulate, yellow, borne in heads on a hollow scape that elongates with age. The heads of seeds are easily recognized because of the parachute-like pappus on each seed.

The part of the common dandelions used as a drug is the "dried rhizome and root."[4] Although taraxacum has long been used in medicine and home remedies, there is, according to the Dispensatory of the United States, "no convincing reason for believing it possesses any therapeutic virtues."

Both dandelions mentioned above are naturalized from Europe. *Taraxacum officinale* is a nearly ubiquitous weed in lawns and meadows throughout the United States. *T. erythrosper-*

[4] The description of the official drug (*2*) specifies "rhizome and root . . . ." It may be questioned that a rhizome is present in dandelions.

PN-703

Figure 18.—Dandelion.

mum, the redseeded dandelion, is less widely distributed and less common.

Dandelions may be cultivated, although it is probably not profitable nor desirable to do so. Roots are collected from naturalized plants for the drug market; however, most of our requirements for the drug are supplied from Europe. The roots are dug in the fall and dried or sliced and dried for the market.

Digitalis

(Foxglove, digitalis leaf, fairy cap, ladys glove, purple foxglove)

Digitalis purpurea L. Scrophulariaceae

Digitalis (fig. 19) is a pubescent biennial, or sometimes perennial, plant, usually 2 to 4 feet tall. The leaves are pubescent, rugose, ovate to ovate-lanceolate, the basal ones petiolate and usually relatively large; those of the stem reduced in size upward, usually short petiolate or sessile. Flowers large, pendulous, 2 to 3 inches long, borne in a simple, usually unilateral raceme, purple to white, usually spotted. There are several cultural forms of the species. The official drug "Digitalis is the dried leaf of *Digitalis purpurea* . . ." (*28*, *p. 212*).

Digitalis purpurea is native to western Europe and is widely naturalized. In America it is commonly found in the coast range of Washington and Oregon in cutover areas; in eastern Canada (Newfoundland and Cape Breton); and in the Andes in South America and south to Chiloé Island at sea level. It is also in Brazil. It has been

PN-725

Figure 19.—Digitalis.

cultivated successfully in the Eastern States and as far west as Minnesota and Michigan, and in many other places.

Digitalis is one of the drugs most commonly used as a cardiac stimulant. It is also used as a tonic and as a diuretic. Digitalis contains several glycosides, of which perhaps the most important is digitoxin; in addition there are present saponins, volatile oil, tannin, and a coloring substance.

Digitalis grows well on ordinary well-drained soils of reasonable fertility. Seeds are usually germinated in flats in a greenhouse or in a hotbed. When danger of frost has passed the seedlings may be hardened off and planted out about a foot apart in rows conveniently spaced for cultivation. Leaves are gathered from both first- and second-year plants. Those collected the second year, before the inflorescence opens, are considered to be best. Leaves must be dried in the shade or dried artifically.

A total of 73 acres of digitalis was in cultivation in 1954 in the United States (*17*, *p. 578*). The average yield for that year was reported as 1,608 pounds per acre. It is possible that the leaves from naturalized plants in Washington and Oregon would nearly supply the demands for the drug in the United States if it were economically feasible to collect them. Most digitalis is now imported.

A second species of digitalis, *Digitalis lanata* Ehrh., has occasionally been in cultivation, and is now being grown commercially in Africa. This species is not official for Digitalis U.S.P., but it may be used for Digitoxin U.S.P. (*28, p. 217*).

See reference *19, pages 444–460.*

Dill

(Dill seed, garden dill, dill weed, dill seed oil or dill oil, dill weed oil or oil of dill)

Anethum graveolens L. Umbelliferae

Dill (fig. 20) is an annual, or occasionally biennial, herb to about 3 feet tall; leaves finely dissected, the segments filiform; umbels large and compound, lacking involucres; flowers yellowish; fruits elliptic, dorsally flattened. The lateral ribs are narrow winged.

Dill is a native of southern Europe. It is grown in temperate or subtropical regions. It has become naturalized, or escaped from cultivation, in many places in the United States and around the world.

Dill is used primarily as a condiment. Both the seeds and the herbage, and the oils from them, are used. Perhaps the best known food product in which dill is used is dill pickles. Many other processed foods contain dill as a flavoring. In medicine dill may be used as a stimulant, aromatic, or carminative, but it is not official.

Two types of oil are made from dill, one from the seeds and one from the herbage. Both oils are extracted by steam distillation, but they are of different composition, odor, and flavor. The dill seed oil is usually preferred as a flavoring material. The seed yields 2.5 to 3.5 percent or more of oil. Yields of 32 to 52 pounds of oil per acre have been reported.

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Figure 20.—Dill.

The yield of dill herb oil may be as little as one-fourth of 1 percent of the weight of the herb distilled. Oil yields of 20 to 30 pounds per acre have been reported.

Dill is not difficult to grow and does well in the North Central States and the Pacific Northwest, where most dill is now grown. Seed is drilled in rows 1 to 3 feet apart, depending on method of cultivation to follow. It is planted in early spring, or in late fall for germination in early spring. Plants are thinned when about 3 inches tall and the plants left 6 to 15 inches apart in the rows. Harvesting depends on use to which plants are to be put. If distillation for dill herb oil is contemplated, then harvest should be immediately after the blooming stage when best quality and flavor of oil is obtained. Distilling equipment, or access to such equipment, is essential for production of the essential oil. Distillation should take place while the herbage is still rather fresh. If a sizable crop is to be grown, then plantings should be staggered so that a large crop will not mature at one time and overtax distilling facilities.

When dill seed or the seed oil is to be the crop, it is harvested as soon as the first seeds are ripe. The harvest is left in the field to dry and mature; or dried in a shed if weather makes it advisable to do this. Shattering is a problem with this crop, so it must be carefully handled to reduce loss. The seed should be carefully dried after threshing to avoid spoilage.

The Census of Agriculture (1954) reported 2,130 acres of dill being grown commercially on 69 farms in the United States. The average yield is given as 32 pounds of oil per acre.

See reference *9, v. 4, pages 619–634.*

Ergot

(Mother of rye, spurred rye, ergot of rye, horn seed)

Claviceps purpurea (Fr.) Tulasne Hypocreaceae

Ergot (fig. 21) is the dried fruiting body of a parasitic fungus that develops in the inflorescence of rye and other cultivated or wild grasses. The fungus attacks the immature seed and eventually replaces it. The ripe fruiting body is called a sclerotium. The sclerotium is normally longer than the seed that it replaces, usually is curved, and is purple or blackish in color. One or more sclerotia may develop in an inflorescence. The official drug (*2, p. 216*) "is the dried sclerotium . . . developed on plants of rye . . . ."

Figure 21.—Ergot on rye. (Courtesy National Fungus Collection.)

Ergot is used medicinally as a emmenagogue; as an hemostatic; principally as a parturient in childbirth. An ergot derivative, lysergic acid diethylamide, has hallucinogenic effects on man and may prove to be most important in the study of schizophrenia.

The active components of ergot are six pairs of sterioisomeric alkaloids. For use in obstetrics these alkaloids are usually not separated.

Ergot occurs on rye in most countries where the crop is cultivated. It also occurs commonly on other grains, especially wheat and barley. Ergot is separated from the grain crop and is itself not specially cultivated as a crop.

Ergot must be well dried and preferably stored in sealed containers to delay the deterioration that is caused by excess moisture. It must also be protected from insect infestation.

Most of the ergot used in the United States until about 1940 was imported. Portugal was the principal source of supply. Since World War II most supplies have come from within the country, much of it from Minnesota. Canada is at present the principal foreign source of ergot.

Ergot in the United States is obtained mostly from the screenings of rye (or wheat). In some parts of Europe where labor is less costly, the ergot is separated from the grain by hand.

See references *3, 6, 32.*

Fennel

(Fennel seed or fruit, oil of fennel)

Foeniculum vulgare Miller Umbelliferae

Fennel (fig. 22) is a short-lived perennial herb, sometimes cultivated as an annual or biennial, 3 to 6 feet tall, branching; leaves pinnately decompounded, the segments filiform and about 1½ inches long, the petioles broad and clasping, sometimes fleshy; umbel of 15 to 20 rays, involucre and involucel lacking; carpels dorsally flattened and with prominent ribs. There are several cultural varieties of fennel. *Foeniculum vulgare* var. *vulgare* yields bitter fennel oil; *F. vulgare* var. *dulce* (Miller) Fiori yields sweet or Roman fennel oil; *F. vulgare* var. *panmorium* DC. yields Indian fennel oil. Fennel is a native of Europe and the Mediterranean region, naturalized widely. The drug is the dry ripe fruit of the above varieties.

Fennel is used as a savory seed, or the oils are used as condiments. In medicine the seeds are used as carminatives, stimulants, or galactagogues. The oil is mildly carminative.

Fennel grows well in mild temperate climates and may be drilled in rows 18 to 36 inches apart in almost any good soil. Planting may be done in early spring or in late fall. When 3 to 4 inches high, plants may be thinned to 8 to 12 inches apart in the rows. Plants also may be started in a seedbed and planted out when 3 to 4 inches tall. Cultivation is the same as for most garden crops. There may be relatively little seed on the crop the first year.

Harvesting may require much hand labor. Fruits in an umbel mature at about the same time, but the umbels on a plant do not all mature at the same time. Machine harvesting, drying, and threshing may be possible, but some immature seeds will be included in the seed harvested;

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Figure 22.—Fennel.

probably there will also be a considerable loss due to shattering. Aphids cause severe damage in fennel, and its culture may be difficult where aphids cause damage to other plants.

There were cultivated in the United States in 1954 (*27, p. 578*) 21 acres of fennel. The average yield per acre is 289 pounds.

Ginger

(Ginger root, ginger rhizome)

Zingiber officinale Roscoe — Zingiberaceae

Ginger (fig. 23) is obtained from perennial plants with aromatic underground stems or rhizomes; stems 2 to 4 feet tall; leaves linear to lanceolate, sessile, 6 to 12 inches long; inflorescence lateral, arising from the rhizome. Possibly it is a native of the Pacific Islands, but now it is distributed over the tropical world; nearly everywhere in the Tropics ginger is collected from spontaneous or semicultivated plants for local use. It is used principally as a condiment.

Ginger can be grown in Florida; in fact, it can be grown where there are light frosts so long as the rhizome remains frost free.

The crop probably cannot be profitably grown in the United States, owing to the large amount of hand labor required in preparing it for market. Almost, if not all, the ginger used in the American market is imported. The finest ginger comes from Trinidad. India is the largest exporter. U.S. imports in 1958 were 1,991 tons.

See reference *1.*

PN-706

Figure 23.—Ginger.

Ginseng

(Sang, ginseng root)

Panax quinquefolius L. — Araliaceae

The ginseng plant (fig. 24, *B*) is about a foot tall; the leaves usually have five leaflets; the mature roots (fig. 24, *A*) are large and spindle shaped, often forked; the fruits are borne in clusters, and when ripe are bright red. The plant was formerly abundant in the United States, but is now scarce, owing to collection of the wild material for many years. The above species is cultivated in America and occasionally elsewhere. It is native to rich, cool woods from Quebec and Manitoba south to northern Florida, Alabama, Louisiana, and Arkansas. It has been cultivated in its natural range and in the Pacific Northwest.

Ginseng root has been used as a medicinal in the treatment of most of the ills to which the flesh is heir. It has been used as a stimulant and aromatic bitter. The Chinese, who use most of that grown, employ it as an aphrodisiac and heart tonic, but without any scientific justification.

Planting material may be either seeds or small plants. Seeds ripen in the fall but usually do not germinate until the following fall and must be "stratified" until used. Stratification consists of storing the seeds in a cool, moist place, using forest soil, sand, loam, or sawdust as a storage medium.

Seeds sown into the permanent beds may be set about 8 inches apart each way. If sown in a seedbed for subsequent transplanting, 2 by 6 inches is sufficient space. The seedlings are transplanted after 2 or 3 years and set at 8-inch intervals. Seedlings purchased from a supplier may be put directly into permanent beds.

The beds should have the centers high enough for good drainage. Good rich forest soil is suitable. The beds should be about 4 feet broad to provide easy access and drainage in the walkways. Ginseng requires enough shade to cut out about three-quarters of the sunlight. This may be accomplished by planting in woods or building lath sheds. Free circulation of air is desirable. Fertilizing with good forest soil or loam is also desirable; most growers advise against the use of chemical fertilizers or barnyard manure. Mulching is needed in most plantations in winter or during dry periods.

Cultivated ginseng probably should not be harvested until 6 years old to obtain the best returns. The roots when mature are usually dug after the growing season is passed. The roots should be carefully dug, cleaned, and dried. Drying is perhaps best carried out in a shed where conditions may be controlled. Ginseng is subject to a number of diseases, some serious.

American ginseng has been in international trade since the early 1700's. About 100,000 pounds are exported annually. The source is from both wild and cultivated plants. Root from wild plants is more valuable than that from cultivated plants. The fluctuation in market value of the root may be rather great from year to year.

See reference *30.*

Goldenseal

(Hydrastis, orange root, yellow root, yellow puccoon, ground raspberry, Indian paint)

Hydrastis canadensis L. — Ranunculaceae

Goldenseal is an erect perennial herb that sends up a single radical leaf and a hairy stem, which is

PN-728

Figure 24.—Ginseng.

2-leaved near the summit. A single whitish flower is borne at the summit of the stem.

The drug consists of the dried rhizomes and roots, which should contain not less than 2.5 percent of anhydrous ether-soluble alkaloids of hydrastis.

Goldenseal is native to the eastern half of the United States, to rich woods from Vermont to Minnesota and Nebraska south to Georgia, Alabama, and Arkansas. The plant has been exterminated in some areas and is now rare in most places, owing to its collection as a drug. The drug was known and used by the Indians before the discovery of America. The plant has been cultivated in the east and also in the Pacific Northwest.

Goldenseal is used as an alterative to the mucous membranes and as a bitter tonic. The evidence on the value of the drug is conflicting.

The culture of goldenseal is not unlike that of ginseng. It may be grown in woodlands or under lath shade. It requires about 75 percent shade in summer. Soil should be well fertilized, and bonemeal or cottonseed meal may be used. The seeds may be sown in a seedbed during October, either broadcast or a half inch apart in rows separated 6 inches. The seed should be covered about 1 inch deep with rich leaf mold or other vegetative material. The seedbeds should be protected by a leaf mulch or burlap during winter. The seedlings when large enough (usually at end of second year) can be transplanted to permanent beds, 6 to 8 inches apart each way, and about 2 inches deep. Sufficient water should be provided and the weeds controlled. Plants may be propagated from divisions of the rhizome, which may be put directly into the beds. It requires about 5 years to mature a crop from seed and a year or two less from divisions. The roots are dug in the fall, after the leaves have withered, cleaned, and then dried in a well-ventilated place in shade or partial sun. They may also be dried in a shed. Roots should be protected from rain and dew. The dried leaves and stems, usually called seal herb, are marketable.

There is perhaps less than 5 acres of goldenseal presently in cultivation. Cost of hand labor and relatively restricted demand have combined to make the crop unpopular.

Henbane

(Hyoscyamus, hyoscyamus herb, hyoscyamus leaves, black henbane, hogs bean, stinking nightshade, poison tobacco)

Hyoscyamus niger L. Solanaceae

Henbane (fig. 25) is a coarse annual, or usually biennial, herb up to 6 feet tall when in flower;

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Figure 25.—Henbane.

root fusiform; leaves sinuate-toothed to pinnatifid, oblong, 3 to 8 inches long, petiolate or sessile and decurrent; flower 1 to 2 inches across, greenish yellow with purple veins. The official drug (*2, p. 289*), called Hyoscyamus, is the dried leaves of this plant, with or without the stems and flowering or fruiting tops. It yields not less than 0.040 percent of the alkaloids of Hyoscyamus. Henbane is native to Europe and Asia. It is now widely naturalized in temperate regions of the world. It is abundantly naturalized and has been harvested from wild plants in the United States, especially in Montana.

The principal active ingredient of henbane is the alkaloid hyoscyamine. It is used as a sedative to the central nervous system, and its most important use is to control certain spasmodic conditions. It is also used in treatment of the alcohol and morphine habits and used in motion sickness, and as a mydriatic.

Field sowing of henbane usually has not been successful. Seed may be best sown in flats in a greenhouse in midwinter, transplanted to pots in March, and to the field in May. Plants may be set out 15 inches apart in rows spaced at least 30 inches apart. Weed control will be necessary to protect the slow-growing plants. Insect pests must be controlled if they appear. The plants are susceptible to a virus, for which no control is known.

The plant thrives in well-drained soils suitable for vegetable crops. It was grown during both World Wars in several States.

The annual type is harvested as soon as the plants are in full bloom. Leaves of the biennial type may be harvested the first year, or the plants may not be disturbed and a full harvest made at flowering time the second year. In harvesting, care should be taken to prevent the soil from adhering to the leaves, which are somewhat sticky. Drying facilities for the harvest must be provided. Yields may reach 500 to 700 pounds of dry herb per acre.

Most henbane used in the country is imported. The culture of the crop is not attractive here under normal conditions, owing to the large amount of hand labor required in its production.

Horehound

(Hoarhound, marrubium)

Marrubium vulgare L. Labiatae

Horehound is a perennial aromatic herb up to 3 feet tall, the stems quadrangular, white tomentose; leaves ovate or ovate-orbicular, ½ to 2 inches long, tomentose, becoming glabrous above; flowers small, white. It is a native of Europe, and naturalized widely.

Horehound is used in domestic medicine as a bitter tonic. The principal use of the herb, however, is as a flavoring in candy and lozenges for coughs.

Horehound grows well in almost any soil. It grows readily from seed, which may be sown early in spring and covered with about an inch of soil. Seeds or cuttings may also be started in a coldframe and transplanted to the field, or divisions of old plants may be used. Plants may be set 6 to 18 inches apart in rows, and close stands produce finer herbs.

Harvesting is done just before full flowering and the herb should be cured in the shade, to preserve the green color. Coarse stems are not desirable. Yields to 2,000 pounds of dry herb per acre have been obtained.

Horehound is a common plant in herb gardens. Most commercial supplies are imported from Europe.

Licorice

(Licorice root, liquorice, Spanish licorice (or liquorice) root, glycyrrhiza)

Glycyrrhiza glabra L. and var. *glandulifera* Waldstein & Kitaibel. Leguminosae

Licorice (fig. 26) is a perennial herb 2 to 4 feet tall, with alternate, odd-pinnate leaves having 9 to 13 ovate leaflets. Flowers are pale blue, in spikes shorter than the leaves. The drug, which is known as Glycyrrhiza, is described officially (*28, p. 312*) (and perhaps incorrectly) as "The dried rhizome and roots . . ." of the plants mentioned above.

Licorice is native to Europe and Asia and widely naturalized around the world. It is often a weed difficult to eradicate. The plant has been known and used since remote times.

The principal use of licorice is as a flavoring and conditioning agent in manufactured tobaccos. It is also the basis of a confectionery. In medicine it is used as a flavoring agent, as a demulcent, and as an expectorant.

Little or no licorice is produced in the United States and that used is imported. In 1958 16,036 tons of licorice root were imported. The three large suppliers were the Soviet Union, Greece, and Iraq. Extract is also imported—167 tons in 1957, mostly from Spain and Turkey.

Licorice grows best in warm regions and usually where there is abundant soil moisture. It requires

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Figure 26.—Licorice.

deep sandy soil of good fertility. Plantings are usually made in spring from crown divisions that are set out about 18 inches apart in rows spaced to permit cultivation. The plant grows slowly and requires 3 to 4 years to produce marketable roots. Harvesting is arduous and requires much hand labor, for the roots are deep; the crowns may be saved and divided for replanting. The roots are dried to approximately half their weight at harvesttime. Drying requires considerable time and must be carefully done. Poorly dried or musty material is rejected by manufacturers. Cultivation of licorice has not been financially successful in the United States.

See reference *14*.

Lobelia

(Indian tobacco, asthma weed, emetic weed, wild tobacco)

Lobelia inflata L. Campanulaceae

Lobelias (fig. 27) are paniculately much-branched annual herbs, to about 3 feet tall, villous or hirsute with long flat hairs. Cauline leaves are obovate or ovate or ovate-lanceolate, mostly sessile, dentate or serrate, often pubescent below. Racemes are terminal, the light-blue flowers rather distant. Calyx is inflated in fruit. The official drug (*2, p. 334*), called Lobelia, "consists of the dried leaves and tops of *Lobelia inflata* Linné." Lobelia is native to the eastern half of the United States and adjacent Canada in fields, open woods, and waste places. It has been cultivated in several places.

Lobelia is said to have been used by the Indians before the discovery of America. Its most important use in medicine is as a nauseating expectorant in treatment of bronchitis. It *should not* be used as an emetic. *Death has often resulted from improper use of this drug as a home remedy.* The principal active constituent of the drug is an alkaloid called lobeline; there are several other constituents.

Lobelia may be sown either in fall or spring in rows about 2 feet apart in well-prepared rich

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Figure 27.—Lobelia.

loam. The seed, which is very small, may be sown on the surface and then the rows firmed by any practical means rather than covering and burying the seed. Fall planting usually gives a better stand and a heavier crop. Shallow cultivation should be given until near harvesttime. Lobelia may be planted in an outdoor bed, prepared as for tobacco, in fall and the seedlings transplanted in spring. Although this method is probably better, it increases labor costs. The crop is harvested when the plants are in full flower and some of the seed pods are mature. Large thick stems should not be harvested. The crop is dried in the shade to preserve the green color. Yields of 1,000 pounds of dry drug per acre have been reported.

Marjoram

(Sweet marjoram, garden marjoram)

Majorana hortensis Moench. Labiatae
(*Origanum majorana* L.)

Marjoram (fig. 28), a perennial herb, ½ to 2 feet tall, is usually cultivated as an annual. Leaves are elliptic-oval, to 1 inch long, entire, tomentose, glandular-punctate. Flowers, in short, ovoid spikes, are white to pink or pale purple. The dried leaves and flowering tops are sometimes used in medicine. Marjoram is native of Europe. It is to be found cultivated in most herb gardens for use in flavoring meats, sausages, salads, various kinds of soups.

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Figure 28.—Marjoram.

Marjoram grows well in good well-drained garden soil. The plant is not hardy in the north, unless heavily mulched, and consequently is usually grown as an annual. It is suggested that the seeds be started in a greenhouse and transplanted after danger of frost has passed. Cuttings may be used for propagation also. Herbage may be cut as needed for home use or the plants harvested by cutting when mature. The plants should be dried in a well-ventilated shed and the leaves separated from the stems by stripping or flailing, when completely dry.

Most majoram used commercially is imported. It is probable that 100 acres of marjoram would supply the needs of the United States.

Mustard

(Black mustard, brown mustard, white mustard)

Brassica nigra (L.) Koch and *Brassica hirta* Moench. (*B. alba* (L) Boiss.)

Cruciferae

Black mustard (*Brassica nigra*) is a much-branched annual plant 2 to 10 or more feet tall. The stem is usually hispid hairy; leaves are variable, petiolate, basal leaves usually not well developed, pinnatifid or lobate, terminal lobe large, margins dentate or coarsely so. Seeds are small, usually black or brown, minutely pitted, one-twenty-fifth to one-twelfth inch long.

White mustard (*Brassica hirta*) is also a sparsely hairy annual up to 4 feet tall, branching above; leaves are oval or ovate to obovate, often deeply lobed or divided into 1 to 3 pairs of lobes. Seeds are mostly light yellow, one-twelfth inch long or usually a bit more, usually quite smooth.

Only black mustard is recognized as official (*2*, *p. 383*) for medical use.

Both kinds of mustard mentioned above are native to Europe and Asia and both are widely naturalized and cultivated around the world—they may become weeds difficult to eradicate.

The principal use of mustard is as a condiment, although there is minor use of it in medicine. Many commercial products are made from or contain mustard. Both a fixed and an essential oil may be obtained from the seed. The paste mustard commonly used as a condiment is usually a combination of the two types of mustard; the black mustard is to add aroma, whereas the white mustard adds pungency.

Most cultivated mustard is grown in the Western States. Montana is the principal producer, with Idaho, Washington, and Oregon also producing some seed. The 1954 Census of Agriculture shows that there were 20,709 acres in the United States planted to mustard, which produced 4,165 tons of seed (401 pounds per acre).

Land to be sown to mustard should be prepared in the fall. Seed may be sown with a seeder in early spring and then the land harrowed. In Montana seeding is done as early as land permits preparation and until the first of June. In the Pacific Coast States seeding is earlier, often as early as January for black mustard and March for white mustard. Seeding is at a rate of 3 pounds of black mustard seed or 4 pounds of white mustard seed per acre. The crop is usually ready to harvest in August or earlier. Shattering is a problem, so harvesting is usually done while the pods are still closed but mature. In Montana most of the crop is harvested with combines.

Mustard is not a difficult crop to grow and usually can be handled with ordinary farm machinery. Soil and climate influence seed quality, so a small trial crop should be grown to see if seed is of acceptable quality.

Mustard is available in the market from the cultivated acreage, from screenings from grain, and from imports.

Parsley

Petroselinium crispum (Miller) Nyman

Umbelliferae

Parsley is a biennial or short-lived perennial, often grown as an annual, with short much-branched stems; leaves ternately decompounded, the leaflets small, ovate, divided or dentate, usually crisped. The fruits (seeds) or the volatile oil from them sometimes is used in medicine. Parsley is native of the rocky shores of the Mediterranean. It is cultivated in most parts of the world and is escaped in many places. It is one of the most commonly used of the condiment plants in flavoring soups, meats, egg dishes, and as a garnish on salads and other dishes. The leaves are

a good source of vitamin C. The roots are often used as a vegetable in Europe.

A rich moist soil is suitable for cultivation of parsley. The plants may be started early in a greenhouse or coldframe then transplanted to the field about 6 inches apart in rows about a foot apart. When the leaves are grown they may be harvested for market or for drying. Seeds are produced the second year and then each year as long as the planting persists. Seed is harvested as soon as ripe and carefully dried.

Peppermint

Mentha piperita L. Labiatae

Peppermint (fig. 29) is thought by some workers to be a hybrid between *Mentha spicata* and *M. aquatica*. The herbs are perennial, with runners or rootstocks and a pungent pepperlike odor; stems erect, branching; leaves petiolate, lanceolate to ovate-lanceolate, sharply dentate, acute, glabrous or sparsely pubescent on the veins below, to about 3 inches long; inflorescences terminal on the stem and branches, spicate, 1 to 3 inches long. The official drug (*28, p. 518*) "Peppermint consists of the dried leaves and flowering tops of *Mentha piperita* Linné."

Peppermint, and especially the essential oil distilled from it, is one of the most commonly used flavoring materials for gum, candies, and many pharmaceutical preparations. It is used in perfume and in perfuming soaps. Production of the essential oil in the United States amounted to about 1,283 tons in 1958.

The Agriculture Handbook cited (*8*) covers culture and other phases of growing this and other kinds of mints. The bulletin may be had from the U.S. Department of Agriculture, Washington 25, D.C.

See references *5, 8*.

Podophyllum

(Podophyllum root, mandrake, may-apple, wild jalap)

Podophyllum peltatum L. Berberidaceae

The flowerless stems of podophyllum (fig. 30) are terminated by large, round, lobed leaves which are peltate in the middle; flowering stems usually have a pair of terminal leaves deeply 3- to 7-lobed and a solitary flower 2 to 3 inches across in the fork of the leaves; fruit is 1 to 2 inches long, sometimes eaten.

The official drug (*28, p. 560*) "Podophyllum consists of the dried rhizomes and roots of *Podophyllum peltatum* Linné. It yields not less than 5 percent of resin." (The average yield is perhaps twice as much.) The rhizome is bitter and acrid to taste.

Podophyllum is used as a cathartic and as a caustic for treatment of certain types of papil-

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Figure 29.—Peppermint.

PN-726

Figure 30.—Podophlylum.

lomas (superficial tumors). The portion used is a resin extracted from the rhizome. It is known as podophyllum resin or as podophyllin. Methods of extraction are given in U.S.P. (*28*). In overdoses it acts as an irritant poison. It forms the basis of several proprietary "liver pills."

Podophyllum rhizome was used empirically by the American Indians as a vermifuge and emetic. The young shoots are said to have been used by Indians for suicidal purposes. The Cherokees, according to Rafinesque, used the fresh juice of the rhizome for deafness, placing a few drops in the ear. The drug became official for the first time in 1864.

Podophyllum is found native in rich, moist woods, thickets, and pastures over much of the eastern half of the United States and of adjacent Canada. It has escaped from cultivation in other places. It is often introduced with intention of exploiting it. It quickly becomes established in appropriate places. More formal cultivation for use as drug is probably rare.

The roots and rhizomes may be harvested at any time when the soil is not frozen. It may best be collected in spring or fall. The resin content is highest in material gathered in the spring. The rhizomes are dug, washed, cut into segments, and dried carefully. Most commercial supplies of podophyllum come from Virginia, North Carolina, Tennessee, Kentucky, and Indiana.

Pokeroot

(Poke, pokeberry, pokeweed, pigeonberry, scoke, garget, red ink plant)

Phytolacca americana L. Phytolaccaceae

Pokeroot (fig. 31) is a glabrous perennial plant, usually with a reddish or purplish cast as it matures. The root is large, much divided and rather fleshy; leaves are broadly lanceolate to ovate, acute, 4 to 5 inches or even more long; fruits are in nodding terminal racemes, dark purple. The tender shoots are edible, both berries and roots are reputed to be poisonous. Sometimes pokeroot is used in medicine as an emetic and in chronic rheumatism.

Pokeweed is native to eastern Canada and New England, south to Florida and Texas. It is usually found in rich low areas and in disturbed locations.

Most root and berries in the drug market are collected from wild or spontaneous plants. The demand is small and it is questionable that formal cultivation would be profitable. Pokeweed grows easily from seed, although germination of untreated seed is slow. It thrives in rich moist soil. Seedlings thinned to stand about 3 feet apart in rows should be acceptable. The root might be harvested by plow the first fall. The second year the crop should be 3 to 4 times greater, and probably it would have to be harvested by hand. A crop of 600 pounds of root per acre may be expected the first year. The plant has been suggested as a crop for greens, and the University of Arkansas has done some experimental work.

PN-713

Figure 31.—Pokeroot.

Psyllium

(Plantago seed, plantago, plantain or plantain seed, psyllium seed, French or Spanish psyllium seed, black psyllium, blond psyllium, Indian plantago seed, flea seed)

Plantago psyllium L., *P. indica* L., and *P. ovata* Forsk. Plantaginaceae

Pysllliums are annual caulescent or acaulescent herbs. The flowers, in bracteate spikes or heads, are usually borne on long scapes or peduncles. *Plantago psyllium* and *P. indica* are caulescent plants with leaves in pairs or whorls; *P. ovata* is acaulescent with linear or lanceolate basal leaves. The official drug (*2, p. 453*), "Plantago Seed is the cleaned, dried, ripe seed" of the three species mentioned above. These species are native to the Mediterranean region and to Asia, all are now spontaneous or naturalized in other parts of the world. The seed of *P. ovata*, blond psyllium, is far more important than the others commercially.

Psyllium, or plantago seed, is used in medicine almost exclusively in the treatment of chronic constipation. The seeds act as a mechanical laxative and the mucilaginous covering tends to absorb water and swell and thus give bulk and softness to the fecal mass.

The mucilage from plantago seed is used as a sizing for cloth, in cosmetics, in printing, and as a basic stabilizer in the ice cream industry.

Psyllium has not been cultivated as a crop in the United States, but some experimental work has been done in Arizona. The results of this experimentation seemed to indicate that the plant can be grown here. *Plantago ovata* is to be preferred over other species.

Seed is planted (in Arizona) after November 1, as shallow as possible, and the soil kept moist for good germination. Frost damage and grasshopper damage were encountered in the experimental studies.

Harvesting, when the seed is mature or ripe, has caused some difficulty, because the plants are not erect and mechanical harvesting is difficult. Crops of about 1,000 pounds of seed per acre have been reported in France. No production data is available for the United States. Mucilage content is normally between 30 to 35 percent in *P. ovata* seeds and may be dry-extracted.

This crop may cause difficulty in the United States as many species of *Plantago* are serious weeds.

Sage

(Salvia, garden sage, true sage)

Salvia officinalis L. Labiatae

Sage (fig. 32) is a herbaceous perennial, or subshrub, to about 2 feet tall, usually white woolly. Leaves are oblong, acute or obtuse, entire or denticulate, petiolate, the surface rugose; inflorescence is simple, terminal or axillary racemes of white, blue, or purple flowers. Sage is rarely used medicinally in this country, although it is said to be used in that manner in Europe.

Sage is perhaps the most used condiment herb and has long been regarded as essential in flavoring of sausages, meats, stuffing for birds, cheeses, and in ground spice mixtures used to flavor foods of many kinds. The essential oil or the oleoresin is sometimes used as flavoring when addition of leaves would make the product unattractive.

Sage is native to the Mediterranean region and is now established and cultivated in many regions. Most of the world supply comes from Yugoslavia and Albania.

Sage may be propagated from stem cuttings, which can be rooted in sand. The cuttings, when rooted, are planted 12 to 18 inches apart in rows 3 feet apart. Larger plantings are made with the seeds drilled about three-fourths inch deep in rows 3 feet apart. The seedlings may be thinned to the desired spacing. Seed may be started also in a coldframe or greenhouse and transplanted by hand or by the machine used to transplant tobacco or vegetable crops. One pound of seed should provide 10,000 to 15,000 seedlings—enough for an acre at the spacing given. The first year's crop from a planting will usually be light, but after the plants are established two or more cuttings a year may be possible. On the second and subsequent years, crops of 1,500 to 2,000 pounds per acre may be obtained.

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Figure 32.—Sage.

Several varieties and clones of sage have been grown. Care should be taken to obtain one that is commercially acceptable.

Harvesting is by hand or by cutting the tops with a mower. Sage is dried in the shade to retain as much of the natural color as possible. Drying sheds may be used or the herb may be dried outside if sun, rain, and dew are avoided. Sage loses flavor with age and exposure to air. It should be baled and marketed as soon as possible. Leaves and small tops bring the best prices. The percentage of stems in sage must be kept at or below 12 percent to comply with the regulation governing this product.

Sage has been successfully grown in the region from Wisconsin to central Georgia and eastward and, especially, in the Pacific Northwest. The plant is usually quite hardy, but it is subject to several diseases. The crop is economically attractive only when sage is not available from areas of relatively cheap labor abroad. About 697 tons of sage were imported from Mediterranean countries in 1958.

See reference *10*.

Sassafras

(White sassafras, oil of sassafras, sassafras oil)

Sassafras albidum (Nutt.) Nees Lauraceae

Sassafras (fig. 33) grows as a tree, with flowers appearing before the leaves; flowers dioecious, borne in several-flowered racemes. Leaves are alternate, entire, or two- or three-lobed; bark is spicy, aromatic.

The official drug (*2, p. 507*) "is the dried bark of the roots . . . ." An essential oil, sassafras oil, which is also official (*2, p. 509*) "is the volatile oil distilled with steam from the roots . . . ." Sassafras occurs as a native over much of the eastern United States, from Maine to Florida and Illinois to Texas. It is often the first tree species to reappear after woods have been cleared. It establishes quickly on abandoned farmland.

Sassafras is used as an aromatic, flavoring agent, and diaphoretic. Perhaps the commonest use is as a home remedy, "spring tonic" used "to thin the blood." Root bark has been used since colonial days to make a tea for this purpose.

Any therapeutic value that it may have is due to the essential oil which it contains. The oil is also an ingredient in sirups to make root beer, sarsaparilla, and other soft drinks.

Sassafras is perhaps nowhere cultivated for its root bark or roots, but the drug is collected from natural stands. Bark is usually collected in summer or fall. The trees are felled, then the roots are pulled, using a tractor. The roots are cleaned of adhering dirt and hauled out to the buyer or distillery. When the ground is frozen the roots do not pull easily, and in spring when the sap is up the bark may slip and be lost when the roots are pulled. The bark and wood of the stem contains too little oil to be distilled profitably.

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Figure 33.—Sassafras.

Senega

(Senega root, seneca snakeroot, rattlesnake root, mountain flax)

Polygala senega L. Polygalaceae

Senega (fig. 34) is a perennial herb with several stems, 1½ feet tall, from a thick crown and with a fleshy, stout root. The leaves are mostly linear-lanceolate to elliptic or ovate, acuminate, to 3 inches long and an inch wide. Inflorescence is a terminal raceme with white flowers. The official drug is the dried root of the plant. It is used as an expectorant for bronchitis and asthma. In overdoses it may become an irritant poison.

Senega is native from New Brunswick to Hudson Bay and Alberta southward to Georgia, Tennessee, and Arkansas.

Propagation may be made from roots collected from wild plants or from seed. Seed must be stratified by mixing with sand and burying it in moist soil until spring, when it may be sown in seedbeds or shallow boxes of loam and leafmold. The seedlings are set out in rows as soon as ready

PN-715

Figure 34.—Senega.

to handle. Senega probably requires 4 years to obtain a crop from seed. There are no data on probable yield. The roots when mature are harvested, washed, and dried.

The supplies of this drug come mostly from Canada, where the plant grows wild in some abundance, occasionally becoming a weed in cornfields. The supply depends on price paid and labor that cannot find more remunerative work. It is doubtful if the plant could be grown economically in the United States as a crop in competition with the wild source.

Sesame

(Sesamum, sesame seed, sesame oil)

Sesamum indicum L. Pedaliaceae

Sesame (fig. 35) is an erect annual herb, usually 2 to 3 feet tall but occasionally to 6 feet or even more, pubescent (or often glandular pubescent) to nearly glabrous; leaves lanceolate or ovate, the lowermost leaves sometimes trilobate. The corolla is about an inch long, white to pale purple, in the axil of leaves or bracts; the capsule is about an inch long. The oil, as used medicinally and officially (*28, p. 628*), is described as "the refined oil obtained from the seed of one or more cultivated varieties of *Sesamum indicum* L. . . . ." It is used as a solvent, emollient, and nutrient (as a substitute for olive oil) and in the manufacture of certain injecta.

Sesame may be native to Africa or India, although India seems more logical. The species is not closely related to the wild species from south of the Sahara in Africa. It has been in cultivation for less than 3,000 years in India, possibly migrating to the region of the Mediterranean at a later date. The plant is now widely cultivated in dry tropical regions and is more commonly grown in temperate regions. It shows promise of becoming an important crop in the United States.

Sesame seed, as a condiment, is commonly used on bakery goods and on various confections and candies. Toasted (and hulled) seed may be used to replace nuts in salads and in other dishes in which nuts are used.

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Figure 35.—Sesame.

The principal economic use of the seed is for the extraction of the edible oil, which is known as sesame oil, teel oil, gingelly oil, or benne oil.

The production of sesame is discussed in a Farmers' Bulletin (*26*).

Spearmint

(Scotch spearmint, scotch mint, spearmint oil)

Mentha cardiaca Baker and *Mentha spicata* L. Labiatae

Spearmint herb consists of the leaves and flowering tops of the two species of *Mentha* (fig. 36) given above. Spearmint oil is the essential oil of these plants distilled with steam from fresh green parts. Both plants are perennials.

Mentha cardiaca is considered by many botanists to be a hybrid between *M. spicata* L. and *M. arvensis* L. *M. spicata* is sometimes considered to be of hybrid origin. It is most variable and hybridizes with several other species of *Mentha*.

The principal use of both the leaf and the oil is for flavoring. Its best known use is for flavoring chewing gum. The oil should contain not less than 55 percent of carvone, the principal constituent. Spearmint has been used as flavoring and as a drug plant since Biblical times. It is not now used in medicine except as flavoring. There are several other species of mints that have the odor characteristic of spearmint.

Both species of spearmint are native in Europe and have been introduced in most parts of the world. Both kinds are cultivated for oil. *Mentha cardiaca* is the one most grown in America.

See references *8*, *21*.

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Figure 36.—Spearmint.

Stramonium

(Jimson weed, Jamestown weed, thornapple, apple-of-Peru)

Datura stramonium L. (*Datura tatula* L.) Solanaceae

Stramonium (fig. 37) is an annual herb, to 5 feet or even more tall, glabrous or sparsely pubescent. Leaves are ovate but with irregular acute lobes or teeth, 3 to 8 inches long; flowers are white or purple, about 4 inches long; the capsule is erect, ovoid, separating into 4 valves, the surface prickley. The official drug (*2*, *p. 560*) consists of the "dried leaves and flowering or fruiting tops with branches . . . ."

Stramonium is a native probably of America; in many tropical and temperate regions of the world it is a naturalized or weedy plant.

Stramonium is used for relief in spasms of bronchial asthma. The constituents are nearly the same as those found in belladonna and are used for the same purpose.

The demand for stramonium is filled normally from imported material or from domestic material collected from naturalized plants. Cultivated material is usually of superior quality and cultivation is relatively easy. Rich heavy soils are best. The seed is drilled in rows about 3 feet apart in the spring. The seedlings should be thinned to

PN-718

Figure 37.—Stramonium.

6 to 10 inches apart in the rows. Control of weeds is necessary. When the plants are in flower, the leaves and tops may be picked by hand. Two or three pickings are possible. A more economical method as to the use of labor is to cut the crop with a mower. After drying, either in the field if weather permits or in a shed, the heavy stem is separated from the leaves by flailing or threshing and discarded. The leaves and small stems are baled for market. Handpicked material is preferred for medical use, but machine-harvested material may be satisfactory for the extraction of the alkaloids.

Stramonium will grow in almost any part of the United States, except some cold or high or dry regions. Measures should be taken to control any leaf-eating pests that attack the crop. Under good conditions yields of 1,000 to 1,500 pounds of dry leaf per acre are obtained. The seed may also be of value, and yields of 500 to 2,000 pounds per acre have been reported. The crop in the United States will probably not be profitable as long as supplies from foreign sources are available.

The use of this plant in home remedies is not recommended. The alkaloids that it contains are extremely poisonous.

Tansy

(Common tansy, golden-buttons)

Tanacetum vulgare L. Compositae

Tansy (fig. 38) is an odorous perennial herb, 2 to 3 feet tall. Leaves are pinnately divided, the segments linear to lanceolate, serrate or pinnately divided. The inflorescence is terminal with axillary corymbs of yellow flowers to a half inch across.

FN-719

Figure 38.—Tansy.

The flowers or herb is used in home remedies; and an essential oil is distilled from the flowers. It is used occasionally as a vermifuge or anthelmintic. The oil is quite toxic and care must be taken in its use.

Tansy is a native of Europe and is now introduced in many areas in the United States, especially the eastern half of the country as an escape or in cultivation.

Tansy grows well in most soils. It may be started in seedbeds from seeds or planting may be made from cuttings or small plants taken from established fields. After one season the crop covers the field. It should be hand weeded, if necessary. Fields once established are easily maintained for years. For production of oil the crop is usually cut with a mower, the herb partially cured in the field, and then distilled. Yields of 10 to 40 pounds of oil per acre are obtained. The plant is usually grown by producers of other essential oil crops who have equipment to distill the herb. The demand for the oil of tansy is limited.

Tarragon

Artemisia dracunculus L. Compositae

Tarragon is a much-branched perennial herb with linear or narrowly lanceolate leaves; flower heads are greenish white, in spreading panicles. Native to Europe, tarragon is widely cultivated for its leaves, which are used, when fresh, for seasoning. An essential oil, called estragon, may be distilled from the plant.

The cultivated plant rarely produces seed, but it is easily propagated by root or crown divisions. The root divisions are set early in spring, spaced 1 foot apart in rows 3 feet apart. The large crown that develops should be taken up and subdivided after 3 or 4 years.

The leaves and tops may be harvested at intervals during the growing season and dried carefully in subdued light to retain the color. The dried product must be stored in tight containers to prevent loss of flavor.

There has been no experience in this country in the growing of tarragon as a volatile-oil crop. In Europe two harvests are obtained. The flowering plants are cut to the ground in July, and new growth develops for a second harvest in September. The oil is distilled like most other volatile oils.

Thyme

(Common thyme, garden thyme, mother-of-thyme)

Thymus vulgaris L. and *T. serpyllum* L. Labiatae

The two species of thyme (fig. 39) are small subshrubs, usually with the stems densely pubes-

PN-720

Figure 39.—Thyme.

cent; the leaves are fragrant. The official drug (*2, p. 610*) is "the dried leaf and flowering tops of *Thymus vulgaris* Linné . . . ." The thymes are native of Europe but are naturalized and cultivated in many parts of the world.

Thymes are used in flavoring foods, especially fish, meats, soups, and dressings. Medicinally, the official species is used as a flavor.

Thyme does well on rich well-drained soils, but it will grow on poor soils. It may be propagated by either seeds or cuttings. When grown from seed it is sown in the field in rows 3 feet apart or started in a greenhouse or seedbed and later transplanted to the field about 18 inches apart in the rows. Cutting or crown divisions may be rooted in sand under glass. Field weeding and cultivation are required. Plants tend to become woody and the crop should be replanted every 2 to 3 years.

Thyme is harvested when the plants are in flower. The herb should be dried in the shade to retain as much color as possible. The quantity of stem must be limited in good quality herb. Harvesting is a problem, for adequate machinery has not been developed. At present hand harvesting and selection are necessary to keep the percentage of stems low. In the United States, cost of hand harvesting, however, may be prohibitive on relatively low value material. Crops of up to 2,000 pounds of dry herb or some 20 pounds of essential oil per acre may be possible.

Valerian

(Valeriana, garden heliotrope, vandal root, St. Georges herb)

Valeriana officinalis L. Valerianaceae

Valerian (fig. 40) is a perennial herb, to 5 feet tall, glabrous, or somewhat pubescent below. Leaves are much divided, usually with 7 to 10

PN-721

Figure 40.—Valerian.

pairs of segments, the segments entire or toothed. Flowers are small, white to lavendar or red, fragrant.

Valerian is native to Europe and Asia. It has been cultivated as a drug plant in Europe but rarely in the United States. The roots are the part of the plant used as a drug. Valerian is not now an official drug in the United States and its value as a drug is sometimes questioned.

Many types of soil are suitable for valerian. It grows best in moist, rich loams. Propagation is by division of the old roots in either fall or spring, and setting them out about 1 foot apart in rows 2 or 3 feet apart has been recommended. Plants may be grown from seeds sown as soon as ripe into a seedbed, and transplanted in early spring. Plants require about a year to mature from cuttings and about 2 years from seedlings. Roots are perhaps best harvested in the fall, cleaned, and then dried. Drying is hastened by cutting the roots lengthwise.

Wintergreen

(Checkerberry, teaberry, gaultheria oil, oil of wintergreen)

Gaultheria procumbens L. Ericaceae

Wintergreen (fig. 41) is a small procumbent subshrub or an almost herbaceous plant, with the

PN-722

Figure 41.—Wintergreen.

flowering branches upright and leafy; leaves are elliptic to obovate, ½ to 2 inches long, tender at first but becoming leathery; flowers are one or few, white, nodding. Oil of wintergreen is not an official drug. It is used, however, as a flavoring and as a stimulant, rubefacient, and an antirheumatic.

Wintergreen is native from eastern Canada, Wisconsin, and Minnesota south through the east to Georgia and Alabama. Most material collected for distillation of the oil comes from wild plants in Pennsylvania and adjacent States. Cultivation is not likely to prove profitable.

Divisions of wild plants may be used for propagation. The divisions should be set out in fall or spring in a well-prepared bed—leafmold mixed with good soil and about 4 inches deep—and placed about 6 inches apart each way. Wintergreen may be harvested from June to the end of the growing season. The leaf material should be delivered to the distillery while still fresh. It may be stored as long as 2 weeks, however, if it is spread out to dry.

See reference *9, v. 6, pages 3 to 7.*

Witch-Hazel

(Hamamelis, Hamamelis leaf, witch-hazel leaves, Hamamelis water)

Hamamelis virginiana L. Hamamelidaceae

Witch-hazel (fig. 42) is a spreading shrub or small tree about 15 feet tall. Leaves are obovate to suborbicular, crenate-dentate, subcordate at the base, nearly glabrous or pubescent, 2 to 6 inches

PN-724

Figure 42.—Witch-hazel.

long. Flowers are yellow, the petals strap shaped, half to nearly an inch long, appearing in the fall after the leaves have fallen. Hamamelis water (*2, p. 270*) is an official drug. It is prepared by macerating in water the recently cut, partially dried, dormant twigs; distilling the material, and then adding 14 or 15 percent of alcohol to the distillate.

Witch-hazel occurs from southeastern Canada to Minnesota and southward to Georgia, Tennessee, and Missouri.

Hamamelis water, commonly called witch-hazel, is used as an astringent. It is used also as a home remedy for aching muscles, irritated skin, and other purposes. There is diversity of opinion as to the therapeutic value of witch-hazel.

Witch-hazel is not cultivated for its medicinal use. The material used comes entirely from wild plants, and in only two rather restricted areas are commercial collections made. In Connecticut, occasionally in Massachusetts and Rhode Island, the bushes are cut in fall and used in the manufacture of hamamelis water, the common witch-hazel of the drugstore. Between 644,000 and 1 million gallons of hamamelis water have been manufactured annually during the last decade. In the southern Appalachians, Virginia, West Virginia, North Carolina, Tennessee, and Kentucky fresh leaves and bark stripped from the branches are collected. This raw material is used in the manufacture of pharmaceuticals and cosmetics.

See reference *7.*

Wormseed

(Chenopodium oil, American wormseed oil, oil of Chenopodium)

Chenopodium ambrosioides L. Chenopodiaceae

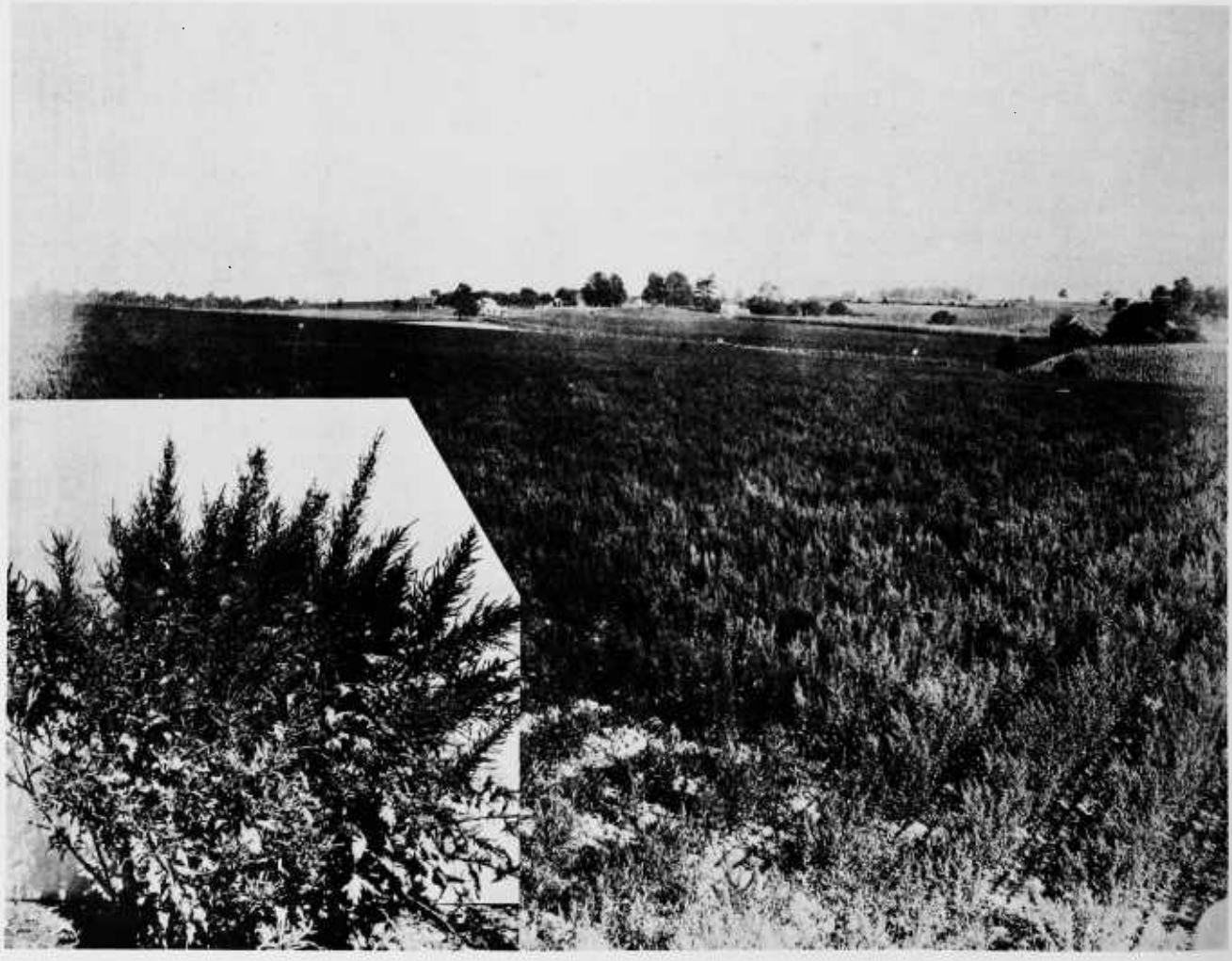
(Syn. *Chenopodium ambrosioides* var. *anthelminticum* (L.) Gray)

Wormseed (fig. 43) is an annual or perennial herb, to 3½ feet tall, much branched, and strong smelling. Leaves are oblong to lanceolate, entire to coarsely toothed or often the lower ones are laciniate. The flowers are in loose spikes, the inflorescences compound in older plants. Seeds about one-thirtieth of an inch broad. The commercial and official (*2, p. 148*) product, "Chenopodium oil is the volatile oil distilled with steam from the fresh, above ground parts of the flowering and fruiting plant . . . ." Wormseed is a native of the West Indies, Central America, and South America. It is now widely naturalized in temperate and tropical regions of the world and cultivated in a few places for the oil that it produces. Carroll County, Md., is perhaps the center of cultivation of the plant.

Chenopodium oil is used as an anthelmintic for both man and animals. *CAUTION! This oil is toxic; it must not be carelessly used.*

The plant grows well under cultivation, and the preparation usually given to cornland is satisfactory for it. Plants may be started in weed-free seedbeds as early as February (in Maryland). Seedlings may be pulled and then transplanted by machine when they are 6 to 8 inches tall. The seedlings are set about 18 inches apart in rows that are 3 feet apart, or the width of rows adjusted to the available cultivating equipment. Cultivation to avoid contamination of the crop by weeds is important. Harvesting should be done at a stage of maturity when about 50 percent of the seeds are black and about 25 percent are brown. Excessive shattering and loss of seed may result if the crop is permitted to mature more. The oil is found on all parts of the plant, but most (90 percent) is on the seed. The plants may be cured several days before being distilled. Shattering and loss of seed should be avoided in handling the crop after drying.

See reference *17*.



PN-727

Figure 43.—Wormseed.

GLOSSARY OF DRUG TERMS

(Excluding Chemical Constituents)

Alterative.—A rather vague term to indicate a substance that hastens renewal of tissues that they may better carry on their function.

Anthelmintic.—A medicine used to expel or destroy intestinal worms.

Antiasthmatic.—A remedy that relieves asthma.

Aphrodisiac.—An agent alleged to stimulate sexual desire.

Aromatic.—An agent or substance added to a medicine to give it aroma or flavor.

Astringent.—An agent which shrinks, blanches, wrinkles, and hardens tissue; diminishes secretions and exudates and coagulates blood.

Bitter.—A drug of bitter taste used to stimulate the appetite.

Carminative.—An agent used to expel gas and relieve colic.

Cathartic.—An agent or drug used to cause an evacuation of the bowel. There are several classes of cathartics that act in different ways to induce evacuation.

Caustic.—A substance that burns organic tissue by chemical action.

Counterirritant.—An agent used to cause irritation to the part to which applied and draw blood away from a deep-seated area.

Demulcent.—An agent used to protect and soothe mucous membranes.

Diaphoretic.—An agent used to increase the perspiration.

Diuretic.—An agent used to increase the flow of urine.

Emetic.—An agent that causes vomiting.

Emmenagogue.—An agent that reestablishes or increases the menstrual flow.

Emollient.—Any agent used externally that softens, makes supple, or soothes and protects the skin.

Expectorant.—An agent used to cause the expulsion of mucus from the respiratory tract.

Flavoring.—Any substance used to give a particular flavor to a medicine.

Galactagogue.—An agent used to increase the secretion of milk.

Hallucinogenic.—An agent that produces hallucinations.

Hemostatic.—An agent used to arrest internal hemorrhage.

Hydragogue cathartic.—A cathartic that causes abundant watery evacuations.

Injecta.—Drugs or agents administered by injection.

Laxative.—A mild cathartic agent that causes a more or less normal evacuation of the bowel, usually without griping or irritation.

Mydriatic.—A medicine or agent causing dilation of the pupil of the eye.

Rubefacient.—An agent that, when applied to the skin, produces a mild irritation accompanied by reddening of the skin.

Sedative.—An agent that allays excitement and soothes the system.

Solvent.—A fluid capable of dissolving substances.

Stimulant.—An agent that increases functional activity.

Stomachic.—An agent used to stimulate the appetite and gastric secretion.

Tonic.—A medicine or agent used to stimulate the restoration of physical or mental tone.

Vermifuge.—A medicine that tends to expel worms.

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